Attorney Docket No.: 121657-3/11944 (21635-0090-D1)
Application No.: 10/758,381

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of:	TEFFT et al.	)	
Application No.:	10/758,381	)	Group Art Unit: 1762
Filed:	January 15, 2004	)	Examiner: Katherine A. BAREFORD

For: HIGH-TEMPERATURE POWDER DEPOSITION METHOD UTILIZING FEEDBACK CONTROL (As Amended)

AMENDED APPEAL BRIEF

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Amended Appeal Brief is being filed within one month from a Notification of Non-Compliant Appeal Brief. The original Appeal Brief was filed on September 12, 2005, which was within two months from the Notice of Appeal submitted August 19, 2005 pursuant to 37 C.F.R. §41.37(a). This Amended Appeal Brief is being submitted in response to a Notification of Non-Compliant Appeal Brief dated March 17, 2006, an Advisory Action dated May 25, 2005, a Final Office Action dated April 26, 2005, a Notice on Non-Compliant Amendment dated February 15, 2005 and a first Office Action dated October 22, 2005.

Appellant has previously authorized the Fee for Filing a Brief in Support of an Appeal of $500.00 and any other charges necessary for consideration of this appeal to be charged to Deposit Account No. 50-1059 with the submittal of the Appeal Brief on August 19, 2005.

Appellant files its Amended Appeal Brief, together with a Fee Transmittal and authorizing payment of the fee. A Notice of Appeal and fee were previously filed.

Real Party in Interest

The real party in interest is the General Electric Company.

Related Appeals and Interferences

Applicant is not aware of any related appeals or interferences.

Status of Claims

This application is a division of application SN 10/177,282, filed June 20, 2002, now U.S. Patent 6,736,902. In the present application, claims 1-14 were initially filed. In a Preliminary Amendment claims 1-11 were cancelled (these were claims related to the parent case), and new claims 15-18 were added. Subsequently, additional new claims 19-25 were added, so that claims 12-25 were pending. During prosecution, claims 15-16 were amended.

Claims 12-25 are pending and were finally rejected in an Office Action dated April 26, 2005 ("Final Office Action" hereinafter). Claims 12-25 are appealed. A copy of claims 12-25 is contained in the Claims Appendix.

Status of Amendments

A Response to Final Office Action was filed, but it contained no claim amendments.

Summary of Claimed Subject Matter

The invention relates to a method for forming a metallic deposit on a deposition substrate by a metal spray technique. More specifically, the claims recite exactly which process parameters must be measured, and how to control the process using those measured process parameters.

When a deposition process is performed manually, the control is based on the judgment of the operator. When a deposition process is to be robotically controlled, the exact process parameters that govern the character of the deposit and of the deposition process must be identified, those process parameters must be measured in real time as the process operates, and those process parameters must be controlled. Figure 1 is a flow chart that illustrates the general approach, and its feedback character. Deposition

apparatus is provided, step 20. The controlling process parameters are measured, step 22, and those measured process parameters are used to set-point control the operating parameters, step 24. The steps 22, 24 are repeated as deposition proceeds, as indicated by the feedback arrow.

More specifically, in the process recited in independent claim 12, a deposition gun 32, such as that illustrated in Figure 3 and discussed in para. [0019] of the Specification at page 5, line 13-page 6, line 6, is provided. The deposition gun 32 burns a mixture of a fuel provided through fuel inlet 36 and an oxidizer provided through oxidizer inlet 38, in a combustion chamber 34. The fuel is burned in the oxidizer to form a deposition gas flow. A powder flow 42 is mixed into the deposition gas flow in a mixer 40 to form a deposition mixture flow 44. The deposition mixture flow 44 is projected from the deposition gun 32 by the force of the expanding deposition gas against a deposition substrate 52 to form a deposit 54. The deposition gun 32 is provided with a flowing coolant, such as water, supplied through a water inlet 58 and removed through a water outlet 60.

The basic structure and operation of such a deposition gun 32 has been known. In the distant past, the deposition gun 32 was normally operated manually by a human operator, and the quality of the deposit was related to the operator's skill. To remove the human factor, it is desired to automate the deposition process, so that the deposition gun is automatically controlled. Various attempts have been made to automate the deposition process, but they have been largely unsuccessful.

To automate the deposition process, the process parameters that govern the process must be identified and then a controller such as a computer is programmed to control those parameters. Identifying the governing process parameters is the biggest challenge, because there are many, many parameters that can be measured, and an even greater number of combinations of the process parameters that could be selected for control.

The present inventors discovered that some specific deposition process parameters are to be measured and then used as the control parameters. Figure 2 schematically illustrates the parameters that are to be measured according to the present approach. As recited in claim 12, the process parameters that are to be measured are (1) a flow rate of the fuel (by a fuel flow sensor 82) to the deposition gun 32, (2) a flow rate of the oxidizer (by an oxygen flow sensor 92) to the deposition gun 32, a flow rate of the powder (by a powder flow sensor 102) to the deposition gun 32, and a cooling capacity (by a coolant sensor 112) of the coolant flow.

These measured parameters are set-point controlled by a controller 70 as illustrated in Figure 2. That is, the flow rate of the fuel (fuel set point 86), the flow rate of the oxidizer (oxygen set point 96), the flow rate of the powder (powder set point 106), and the cooling

capacity of the coolant flow (water control set point 116) are all set-point controlled, all responsive to the values measured in the step of measuring.

The process recited in the other independent claim, claim 19, has the same main process steps, and the prior description is incorporated.

The differences in claims 12 and 19 are that claim 19 recites the preferred embodiment more specifically.

The deposition gun is recited to be a high-velocity oxyfuel deposition gun. The coolant is specified to be water.

Exactly the same process parameters are measured in the recitation of claim 19 as in the recitation of claim 12.

Exactly the same parameters are set-point controlled in the recitation of claim 19 as in the recitation of claim 12.

As noted above, the key is identifying which process parameters are to be measured and used as the basis for process control. As will be discussed in relation to the prior art rejections, others have chosen different parameters to be measured and controlled.

Yet others have chosen to control particular process parameters but not to measure them. As stated in para. [0026] of the present Specification at page 7, lines 25-30:

> "This feedback control system of the deposition controller 70 was found necessary because the performance of the deposition gun 32 is highly sensitive to slight variations in these operating parameters. Without the feedback control system, normal operating variations from the set points would result in a substantial change in the performance of the deposition gun 32 and in some cases the quality of the deposit 54."

That is, small, normal variations in gas flow rates, powder flow rates, and cooling capacity can adversely affect the deposition process, requiring measurement of these process parameters and feedback control of the process responsive to these measurements.

Grounds of Rejection to be Reviewed on Appeal

1) Whether claims 12-17 and 19-24 are unpatentable under 35 USC 103 over Moore US Pub. 2003/0161946 in view of Knight et al. Article.

2) Whether claims 18 and 25 are unpatentable under 35 USC 103 over Moore in view of Knight et al. Article, and further in view of Nakagawa U.S. Patent 5,958,522.

Argument

A. Discussion of Ground 1

Ground 1. Whether claims 12-17 and 19-24 are unpatentable under 35 USC 103 over Moore U.S. Pub. 2003/0161946 in view of Knight et al. Article.

Moore teaches deposition processes, but admittedly lacks a teaching of key features of the present approach, as recognized in the first paragraph on page 4 of the Final Office Action. The lack of teaching in Moore includes the specific features that are measured and used for feedback control (which of course is the heart of the invention), the features of the HVOF spray gun, and the instrumentation that is used to perform the measurements of process parameters.

Moore also fails to teach controlling of process parameters of the deposition gun based upon measurements of those same process parameters. In para. [0034], Moore states, "Controller 15 may monitor the coating process using the sensors, as preciously [sic, previously] discussed, and...automatically adjust the operation..." The "sensors" referred to in this sentence are not sensors of gas flows, powder flows, and/or coolant flows, the process parameters of the deposition gun which may be controlled. The "sensors" are described in para. [0028] of Moore, and include sensors of coating parameters such as visual image, electrical properties of the coating, distance between the spray gun and the coating, temperature of the coating/substrate, and coating thickness. Moore never suggests measuring gas flow rates, powder flow rates, and cooling capacity of the deposition gun, and then controlling the deposition gun responsive to those measurements.

Knight is applied because it is said to teach these missing elements, but it clearly does not. A careful reading of the discussion of the asserted teachings of the Knight reference in the Final Office Action at page 4, second full paragraph, reveals that there is no assertion that Knight measures any process parameters and then does responsive set point controlling based on those measured process parameters. At page 159, Knight mentions some parameters that may be fixed. At page 160, second column, under the heading Methodology, Knight clearly teaches that three "key spray parameters--surface speed of the part, spray distance, and fuel:oxygen ratio" are set to specific nominal values for each test, and that all other parameters remain constant at baseline values. Knight never suggests

that any parameters are measured and then used as the basis for controlling the deposition process.

The approach by which the rejections are constructed makes a fundamental error in logic. It assumes that because a parameter is controlled, it is also measured and used to control the parameter in a feedback manner. A person can control the flow of a kitchen faucet without measuring the flow rate of water flowing from the faucet and controlling the faucet based on that measurement, and instead observing whether a bucket has been filled by the flow of the faucet (i.e., the results of the operation of the faucet), in a manner analogous with what Moore and Knight are teaching.

Throughout the long paragraph bridging pages 4-5 of the Final Office Action, the explanation of the rejection seeks to apply a broad brush to the teachings of the references, suggesting that because Moore says to control gas flow rate there is an implication that Moore measures gas flow rate with the "sensors." That is not correct. As discussed above, the parameters measured by Moore and used by the controller are not the flow rates of gases, flow rate of powder, or cooling capacity. Instead, the measured coating parameters include visual image, electrical properties of the coating, distance between the spray gun and the coating, temperature of the coating/substrate, and coating thickness.

Moreover, the process control approach of Knight is contrary to that of Moore. Knight's control approach is discussed at page 160, second column under Methodology. Moore teaches that properties of the coating are measured and used in control. Knight teaches that three parameters are varied: surface speed of the part, spray distance, and fuel:oxygen ratio (keeping total gas flow constant), and everything else is kept constant. If one of ordinary skill were reading these two references, that person would not know whether to follow the control approach of Moore or that of Knight, but in any event both approaches are different from the presently claimed approach.

The present claims define differences in the two prior art approaches and the presently claimed approach. The following principle of law applies to all sec. 103 rejections. MPEP 2143.03 provides "To establish prima facie obviousness of a claimed invention, all claim limitations must be taught or suggested by the prior art. In re Royka, 490 F2d 981, 180 USPQ 580 (CCPA 1974). All words in a claim must be considered in judging the patentability of that claim against the prior art. In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970)." [emphasis added] That is, to have any expectation of rejecting the claims over a single reference or a combination of references, each limitation must be taught somewhere in the applied prior art. If limitations are not found in any of the applied prior art, the rejection cannot stand. In this case, the applied prior art references clearly do not arguably teach some limitations of the claims.

Claims 12 and 19

Each of claims 12 and 19 recites in part:

> "measuring a flow rate of the fuel to the deposition gun, a flow rate of the oxidizer to the deposition gun, a flow rate of the powder to the deposition gun, and a cooling capacity of the coolant flow;"

Moore has no teaching of this limitation, see first paragraph on page 4 of the Final Office Action. The explanation of the rejection asserts (page 4, first and second paragraphs) that the Knight Article teaches this limitation. Applicant respectfully traverses this assertion. Knight teaches that certain parameters may be variables, but says nothing about them being measured (second full paragraph in right hand column on page 159; second column on page 160, under Methodology). There is no teaching on page 159 or page 160 or elsewhere that fuel flow rate and oxygen flow rate are even of interest (only the ratio is mentioned).

Further to the point, in the paragraph immediately below Table I on page 160, Knight Article identifies the "three key spray parameters: surface speed of the part, spray distance, and fuel:oxygen ratio" that are varied. The Knight Article teaches that "all other parameters were fixed at the baseline values" (page 160, first paragraph after Table I). No mention is made of flow rates of fuel, oxidizer, and powder, and cooling capacity as being important parameters to be measured or controlled, and in fact the teaching is that all parameters are kept fixed at the baseline values, except for the three listed above. Nor is any mention made of "measuring" these quantities during operation of the HVOF apparatus. As the caption to Table I states, the manufacturer's "recommended" operating parameters, except for the" three key spray parameters", were used.

Each of claims 12 and 19 further recites in part:

> "set-point controlling the flow rate of the fuel, the flow rate of the oxidizer, the flow rate of the powder, and the cooling capacity of the coolant flow, <u>all responsive to the step of measuring</u>." [emphasis added]

Neither reference has any such teaching.

It is important to distinguish what parameters the references suggest may be measured, from what parameters the references suggest may be measured <u>and</u> controlled.

Moore teaches using a feedback controller, and in para. [0028] mentions parameters that may be used as the basis for the feedback control. There is no teaching of using flow

rates of fuel or oxidizer, flow rate of powder, or cooling capacity as the basis for set-point controlling. Moore teaches measuring parameters such as visual image, electrical properties of the coating, distance between the spray gun and the coating, temperature of the coating/substrate, and coating thickness (not operating parameters of the deposition gun) and uses those measured parameters to control the deposition process.

Knight does not mention any type of set point controlling responsive to a measuring step. Knight sets parameters at particular values and leaves them set at those respective values.

The fact of the matter is that neither reference points the way to the measurement of specific recited process parameters of the deposition gun, and active control of any of those same process parameters recited in the present claims.

Para. [0029] of the present Specification presents a direct experimental comparison between the present approach and the closest prior art. The present approach produced surprising and unexpected improvements in the performance of the sprayed coatings.

The following discussion addresses dependent claims. In each case, these claims are patentable because they incorporate the limitations of their respective parent claims, which are not taught by the references for the reasons discussed above and which are incorporated into each of the following discussions. These dependent claims are also patentable for the additional reasons discussed below under each heading.

<u>Claims 13 and 20</u>

Each of claims 13 and 20 recites in part:

"measuring a coolant temperature of the coolant flow."

Neither reference has any such teaching. Moore measures (para. [0028]) coating parameters such as visual image, electrical properties of the coating, distance between the spray gun and the coating, temperature of the coating/substrate, and coating thickness. Moore never suggests measuring gas flow rates, powder flow rates, and cooling capacity, and then controlling the deposition gun responsive to those measurements. Knight never suggests measuring coolant temperature.

The explanation of the rejection never addresses these claims and this limitation, presumably conceding that the reference does not teach this limitation.

Claims 14 and 21

Each of claims 14 and 21 recites in part:

"measuring a coolant flow rate of the coolant flow."

Neither reference has any such teaching.

Once again, it is important to distinguish between what is controlled as compared with what is measured and controlled based upon the measured value. Moore never suggests measuring a coolant flow rate and then controlling the deposition gun responsive to that measurement. Moore measures (para. [0028]) coating parameters such as visual image, electrical properties of the coating, distance between the spray gun and the coating, temperature of the coating/substrate, and coating thickness, and controlling the process based on those parameters (para. [0033]). Moore speaks of controlling the coolant flow rate (para. [0033]), but never suggests measuring the coolant flow rate and thence using that measurement as the basis for feedback control. Knight never suggests measuring coolant flow rate.

Claims 15 and 22

Each of claims 15 and 22 recites in part:

"providing the deposition gun comprising

the combustion chamber wherein a mixture of the fuel and the oxidizer is burned to generate a pressurized deposition gas flow,

the mixer wherein the pressurized deposition gas flow is mixed with a powder flow to form a deposition mixture flow,

a deposition flow director that receives the deposition mixture flow from the mixer and directs the deposition mixture flow toward the deposition substrate, and

a cooling structure operable with a flowing coolant passing therethrough and in cooling communication with the mixer and with the deposition flow director."

Neither of the references has any such teaching. Neither reference ever describes the structural details of its deposition device.

Knight describes some apparatus features, but there is no reason to believe that Moore contemplates such an apparatus or that the control approach of Moore (which is different from that recited in the present claims) would be used with such an apparatus. The fact that an apparatus exists does not suggest that the approach of Moore would be operable with that apparatus.

Claims 16 and 23

Each of claims 16 and 23 recites in part an instrumentation array providing:

> "a fuel measurement of the flow rate of the fuel to the combustion chamber,
>
> an oxidizer measurement of the flow rate of the oxidizer to the combustion chamber,
>
> a powder measurement of the flow rate of the powder feed to the mixer, and
>
> a coolant measurement of the cooling capacity of the coolant."

The explanation of the rejection is correct that Moore teaches "some type of instrumentation array." The instrumentation array of Moore is described in para. [0028] of Moore, and includes sensors for measuring coating parameters such as visual image, electrical properties of the coating, distance between the spray gun and the coating, temperature of the coating/substrate, and coating thickness. Neither Moore nor Knight ever suggests measuring gas flow rates, powder flow rates, and cooling capacity, and then controlling the deposition gun responsive to those measurements.

Claims 17 and 24

Each of claims 17 and 24 recites in part:

> "...providing a deposition controller including
>
> a controllable fuel source of the fuel communicating with the combustion chamber, wherein the controllable fuel source is automatically controlled responsive to the fuel measurement,
>
> a controllable oxidizer source of the oxidizer communicating with the combustion chamber, wherein the controllable oxidizer source is automatically controlled responsive to the oxidizer measurement,

a controllable powder source of the powder flow communicating with the mixer, wherein the controllable powder source is automatically controlled responsive to the powder measurement, and

a controllable coolant source of a flow of the coolant that provides an inlet flow of coolant to the cooling structure, wherein the controllable coolant source is automatically controlled responsive to the coolant measurement."

Neither reference teaches, for example, "a controllable fuel source of the fuel communicating with the combustion chamber, <u>wherein the controllable fuel source is automatically controlled responsive to the fuel measurement</u>" [emphasis added] (referring to the first of the above four subparagraphs of the claim, but the same point applies for each of the four subparagraphs). Neither reference teaches a fuel measurement, so there is no controllable fuel source that can be controlled responsive to a fuel measurement.

As stated in para. [0026] of the present application:

"This feedback control system of the deposition controller 70 was found necessary because the performance of the deposition gun 32 is highly sensitive to slight variations in these operating parameters. Without the feedback control system, normal operating variations from the set points would result in a substantial change in the performance of the deposition gun 32 and in some cases the quality of the deposit 54."

Para. [0029] of the present Specification presents a direct experimental comparison between the present approach and the closest prior art, including a comparison where parameters were measured but not used as the basis for feedback control. The present approach produced surprising and unexpected improvements in the performance of the sprayed coatings.

The following point applies to the rejection of all of the claims, under both this first issue and the second issue.

The present rejection is a sec. 103 combination rejection. It is well established that a proper sec. 103 combination rejection requires more than just finding teachings in the references of the elements recited in the claim (but which was not done here). To reach a proper teaching of an article or process through a combination of references, there must be stated an objective motivation to combine the teachings of the references, not a hindsight rationalization in light of the disclosure of the specification being examined. MPEP 2143 and 2143.01. See also, for example, <u>In re Fine</u>, 5 USPQ2d 1596, 1598 (at headnote 1) (Fed.Cir. 1988), <u>In re Laskowski</u>, 10 USPQ2d 1397, 1398 (Fed.Cir. 1989), <u>W.L. Gore &</u>

Associates v. Garlock, Inc., 220 USPQ 303, 311-313 (Fed. Cir., 1983), and Ex parte Levengood, 28 USPQ2d 1300 (Board of Appeals and Interferences, 1993); Ex parte Chicago Rawhide Manufacturing Co., 223 USPQ 351 (Board of Appeals 1984). As stated in In re Fine at 5 USPQ2d 1598:

> "The PTO has the burden under section 103 to establish a prima facie case of obviousness. [citation omitted] It can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references."

And, at 5 USPQ2d 1600:

> "One cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention."

Following this authority, the MPEP states that the examiner must provide such an objective basis for combining the teachings of the applied prior art. In constructing such rejections, MPEP 2143.01 provides specific instructions as to what must be shown in order to extract specific teachings from the individual references:

> "Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention when there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); In re Jones, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992)."
>
> * * * * *
>
> "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." In re Mills, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990)."
>
> * * * * *
>
> "A statement that modifications of the prior art to meet the claimed invention would have been 'well within the ordinary skill of the art at the time the claimed invention was made' because the references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a prima facie case of obviousness without some

objective reason to combine the teachings of the references. Ex parte Levengood, 28 USPQ2d 1300 (Bd.Pat.App.& Inter. 1993)."

Here, there is set forth no objective basis for combining the teachings of the references in the manner used by this rejection, and selecting the helpful portions from each reference while ignoring the unhelpful portions. An objective basis is one set forth in the art or which can be established by a declaration, not one that can be developed in light of the present disclosure.

The paragraph bridging pages 4-5 of the Final Office Action presents a hindsight rationale for measuring and controlling various parameters, but in fact neither reference teaches measurement of the recited parameters during operation and control of the deposition apparatus. As noted above, Moore lists some measured parameters of interest, but not those recited in the present claims. The explanation of the rejection 3-4 lines from the top of page 5 of the Final Office Action asserts that "Knight Article teaches that desirable feature to control...", but in fact Knight Article sets those values at the recommended values of the manufacturer of the apparatus, and does not control or vary them at all responsive to any measurement, while intentionally varying the different "three key spray parameters." If anything, Knight Article teaches directly away from the present approach, and is wholly inconsistent with the asserted teachings of Moore. The whole point of the presently claimed approach is that using the recited parameters provided by the manufacturer is not satisfactory, see the comparative results of para. [0029] of the present application.

But even if the teachings are improperly combined, Moore and Knight Article do not reach the recited claim limitations. Moore does not mention measuring and controlling on the parameters recited in the present claims, and instead directs attention to other parameters. The Knight Article teaches that the parameters recited in the present claims are kept fixed at baseline values, to the extent that these parameters are addressed.

Applicant addresses the Response to Arguments found at page 7 et seq. of the Final Office Action.

If Applicant understands the Response at pages 7-8 correctly, the Examiner takes the position that neither reference teaches the specific claim limitations discussed above. The broad generalizations of para. [0032]-[0034] of Moore do not teach these specific limitations.

The reference in Moore to controlling "all the components" means what it says--the physical components are controlled ("components" are not "process variables"). The references to "coating process parameters" are all measurable parameters of the coated article. There is no suggestion of measuring and controlling parameters related to the

inputs to a deposition device, and certainly no mention at all of the specific inputs to the deposition gun recited in the present claims. That individual fuel flow rate and oxygen flow rate may vary has no relation to the teaching of the measurement of the ratio of fuel flow rate to oxygen flow rate.

Knight does not aid the case of the rejection, because Knight identifies the "three key spray parameters: surface speed of the part, spray distance, and fuel:oxygen ratio" that are varied. These parameters are not even mentioned by Moore. Knight does not suggest varying the parameters that are mentioned by Moore. Knight goes on to teach that "all other parameters were fixed at the baseline values." If the Examiner has any way to reconcile these contrary teachings of Moore and Knight, Applicant asks that it be set forth in the Examiner's Answer. Otherwise, Applicant will take it as admitted that the two references teach contrarily to each other, with completely disjoint sets of parameters to be controlled.

Regarding claims 13-14, these claims recite "measuring" recited parameters. In para. [0033], Moore teaches "controlling" parameters, but makes no mention of "measuring" those parameters.

Regarding claim 15, the Response suggests that various recited components are taught by Knight, but they are simply not disclosed, except for the combustion chamber.

Regarding claims 16-17, Applicant appreciates that the Examiner has asserted that the recited features are present in the teachings of the references, but that does not cause them to actually be present. Absent specifically pointing out where the recited features are said to be taught in the references, Applicant will take it as admitted that they are not taught by the references.

Regarding the combination of references, neither of the Office Actions provides a reconciliation of the directly contrary teachings of the two references that Moore is said to teach that everything is controlled, while Knight says that everything is kept constant except for variations in three specific parameters (none of which are parameters recited in the present claims). This does not provide a basis for combining the teachings of the references.

Applicant performed experimental comparisons that demonstrated the surprising and unexpected advantages of the present approach over the closest prior art, see para. [0029] of the present application. The Examiner responds by suggesting that Applicant has not performed the proper experimental comparison. The Examiner suggests that a proper experimental comparison is to "Moore in view of Knight Article" (page 8, line 14-page 9, line 1 of Final Office Action). But no such thing exists. This is a hypothetical construct of a patent examiner as to what a person of ordinary skill might do, and has no relation to current reality. Further, the proposed combination of "Moore in view of Knight Article" is

argued to teach the present invention, so the suggested comparison is the present invention to itself. The hypothetical construct "Moore in view of Knight Article" does not in any event teach the recited parameters discussed earlier. Applicant has provided an experimental comparison to the closest actual prior art currently in use by those who actually do work in this field.

B. Discussion of Ground 2

Ground 2. Whether claims 18 and 25 are unpatentable under 35 USC 103 over Moore in view of Knight et al. Article, and further in view of Nakagawa US Patent 5,958,522.

Claim 18 depends from claim 12, and claim 25 depends from claim 19. The limitations of the parent claims are not taught by the combination of Moore and Knight Article for the reasons discussed above and which are incorporated here. Nakagawa adds nothing in this regard.

Moore has no teaching that its approach is operable with hydrogen/oxygen, and no teaching that its various control features are operable with hydrogen/oxygen fuel/oxidizer.

Nakagawa is nonanalogous art. The Moore and Knight references deal with HVOF process, and it is for these teachings that the references are relied upon, see page 3, line 6 and page 4, line 4 of the Final Office Action. Nakagawa has no mention of HVOF. Nakagawa deals with thermal spray, not HVOF. So whatever Nakagawa teaches about hydrogen/oxygen ratio, there is no reason to believe that it has any relevance to parameters in an HVOF process such as that taught by Moore and Knight Article.

It also appears that Nakagawa does not contemplate the use of "a deposition gun that burns a mixture of a fuel and an oxidizer to form a deposition gas flow, mixes a powder into the deposition gas flow to form a deposition mixture flow, and projects the deposition mixture flow therefrom," as recited in claim 12 and thence in claim 18, and as recited in claim 19 and thence in claim 25. The device pictured in Figure 1 of Nakagawa is not of this type, so Nakagawa's teachings are not relevant to those of Moore and Knight, and are not relevant to the presently recited invention.

The Response, in the paragraph bridging pages 10-11 of the Final Office Action, addresses the "shape" of the device in Nakagawa as compared with the "shape" of the device in Knight. The shapes of the two deposition devices are not relevant. The issue is whether they function in a similar manner. They do not, see the discussion above. The Response refers to "art recognized equivalents", but no evidence is provided that different types of deposition devices are "equivalents", or that different fuel/oxidizer types are

"equivalents" in respect to a hydrogen/oxygen ratio, the latter particularly in view of Knight Article's statement at page 160 that different types of fuels are not equivalent.

SUMMARY AND CONCLUSION

The present claims recite a control approach wherein recited parameters are measured, and then "set-point controlling the flow rate of the fuel, the flow rate of the oxidizer, the flow rate of the powder, and the cooling capacity of the coolant flow, all responsive to the step of measuring." [emphasis added] The references teach away from this recited approach. Moore teaches measuring different parameters and controlling based upon those parameters, and Knight teaches setting fixed values and not controlling the process at all responsive to measurements of those values.

Applicant asks that the Board reverse the rejections.

Respectfully submitted,

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Attachments (Claims Appendix, Evidence Appendix, and Related Proceedings Appendix)

CLAIMS APPENDIX

Unmarked copy of claims as of the Final Office Action dated April 26, 2005, the last form acted on by the Examiner.

12. A method for forming a deposit on a deposition substrate, comprising the steps of

providing a deposition gun that burns a mixture of a fuel and an oxidizer to form a deposition gas flow, mixes a powder into the deposition gas flow to form a deposition mixture flow, and projects the deposition mixture flow therefrom, wherein the deposition gun is provided with a flowing coolant;

measuring a flow rate of the fuel to the deposition gun, a flow rate of the oxidizer to the deposition gun, a flow rate of the powder to the deposition gun, and a cooling capacity of the coolant flow; and

set-point controlling the flow rate of the fuel, the flow rate of the oxidizer, the flow rate of the powder, and the cooling capacity of the coolant flow, all responsive to the step of measuring.

13. The method of claim 12, wherein the step of measuring comprises a step of measuring a coolant temperature of the coolant flow.

14. The method of claim 12, wherein the step of measuring comprises a step of measuring a coolant flow rate of the coolant flow.

15. The method of claim 12, wherein the step of providing the deposition gun includes the step of

providing the deposition gun comprising

a combustion chamber wherein a mixture of the fuel and the oxidizer is burned to generate the deposition gas flow under pressure,

a mixer wherein the pressurized deposition gas flow is mixed with a powder flow to form the deposition mixture flow,

a deposition flow director that receives the deposition mixture flow from the mixer and directs the deposition mixture flow toward the deposition substrate, and

a cooling structure operable with the flowing coolant passing therethrough and in cooling communication with the mixer and with the deposition flow director.

16. The method of claim 15, wherein the step of measuring the flow rate includes the step of providing an instrumentation array providing

a fuel measurement of the flow rate of the fuel to the combustion chamber,

an oxidizer measurement of the flow rate of the oxidizer to the combustion chamber,

a powder measurement of the flow rate of the powder to the mixer, and

a coolant measurement of the cooling capacity of the coolant.

17. The method of claim 12, wherein the step of set point controlling includes the step of providing a deposition controller including

a controllable fuel source of the fuel communicating with the combustion chamber, wherein the controllable fuel source is automatically controlled responsive to the fuel measurement,

a controllable oxidizer source of the oxidizer communicating with the combustion chamber, wherein the controllable oxidizer source is automatically controlled responsive to the oxidizer measurement,

a controllable powder source of the powder flow communicating with the mixer, wherein the controllable powder source is automatically controlled responsive to the powder measurement, and

a controllable coolant source of a flow of the coolant that provides an inlet flow of coolant to the cooling structure, wherein the controllable coolant source is automatically controlled responsive to the coolant measurement.

18. The method of claim 12, wherein the fuel is hydrogen gas and the oxidizer is oxygen gas, and wherein the step of set point controlling includes the step of

controlling a flow ratio of the hydrogen gas to the oxygen gas to be from about 2.2 to about 2.6.

19. A method for forming a deposit on a deposition substrate, comprising the steps of

providing a high-velocity oxyfuel deposition gun that burns a mixture of a fuel and an oxidizer in a combustion chamber to form a deposition gas flow, mixes a powder into the deposition gas flow after the deposition gas flow leaves the combustion chamber and enters a mixer to form a deposition mixture flow, and projects the deposition mixture flow therefrom, wherein the deposition gun is provided with a flowing water coolant;

measuring a flow rate of the fuel to the deposition gun, a flow rate of the oxidizer to the deposition gun, a flow rate of the powder to the deposition gun, and a cooling capacity of the flowing coolant; and

set-point controlling the flow rate of the fuel, the flow rate of the oxidizer, the flow rate of the powder, and the cooling capacity of the coolant flow, all responsive to the step of measuring.

20. The method of claim 19, wherein the step of measuring comprises a step of measuring a coolant temperature of the coolant flow.

21. The method of claim 19, wherein the step of measuring comprises a step of measuring a coolant flow rate of the coolant flow.

22. The method of claim 19, wherein the step of providing the deposition gun includes the step of

providing the deposition gun comprising

the combustion chamber wherein a mixture of the fuel and the oxidizer is burned to generate a pressurized deposition gas flow,

the mixer wherein the pressurized deposition gas flow is mixed with a powder flow to form a deposition mixture flow,

a deposition flow director that receives the deposition mixture flow from the mixer and directs the deposition mixture flow toward the deposition substrate, and

a cooling structure operable with a flowing coolant passing therethrough and in cooling communication with the mixer and with the deposition flow director.

23. The method of claim 22, wherein the step of measuring the flow rate includes the step of providing an instrumentation array providing

a fuel measurement of the flow rate of the fuel to the combustion chamber,

an oxidizer measurement of the flow rate of the oxidizer to the combustion chamber,

a powder measurement of the flow rate of the powder feed to the mixer, and

a coolant measurement of the cooling capacity of the coolant.

24. The method of claim 19, wherein the step of set point controlling includes the step of providing a deposition controller including

a controllable fuel source of the fuel communicating with the combustion chamber, wherein the controllable fuel source is automatically controlled responsive to the fuel measurement,

a controllable oxidizer source of the oxidizer communicating with the combustion chamber, wherein the controllable oxidizer source is automatically controlled responsive to the oxidizer measurement,

a controllable powder source of the powder flow communicating with the mixer, wherein the controllable powder source is automatically controlled responsive to the powder measurement, and

a controllable coolant source of a flow of the coolant that provides an inlet flow of coolant to the cooling structure, wherein the controllable coolant source is automatically controlled responsive to the coolant measurement.

25. The method of claim 19, wherein the fuel is hydrogen gas and the oxidizer is oxygen gas, and wherein the step of set point controlling includes the step of

controlling a flow ratio of the hydrogen gas to the oxygen gas to be from about 2.2 to about 2.6.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.